Ideal-driven customization of touristic decision based on artificial intelligence concerning accommodations

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Abstract

In today's technological landscape, booking accommodations has become increasingly convenient. Rapid technological advancements have not only transformed our lifestyles but also given rise to new behavioural patterns and communication habits. Thanks to AI-based decision-making, various sectors including tourism are benefitting from optimized customer-oriented solutions. Both traditional procurement processes and value-driven decision-making rely on OAMs (object-attribute-matrix versions: c.f. https://miau.my-x.hu/miau2009/index.php3?x=e0&string=ideal-).

Leveraging Artificial Intelligence, tourism businesses can gather, analyze, and store vast amounts of data (c.f. in case of accommodation: each potential aspects of the services e.g. smoking, parking, shower, towels, distances from important environmental objects, etc.) This data empowers hotels and online travel platforms to deliver personalized tourism offerings to both business and leisure travelers, taking into account the location of the accommodation and the value-price ratio. Unlike traditional methods, which optimize based on a price-performance ratio, customers can now specify their preferences (c.f. an ideal service/object), such as more or less distance from the city center correlating with higher or lower prices and this direction-oriented preference-system should be defined for each attribute. Decision-making scenarios driven by human ideals involve a hypothetical "dream accommodation," against which real accommodations are measured by their virtual multi-dimensional distances, rather than their actual performance characteristics. In this context, lower distances from the ideal object may correspond to higher prices for accommodations. This is a totally new approach concerning customization robotized.

In the methodology section of the article, the authors emphasize that accommodations possess virtually limitless attributes, but a genuine OAM cannot be readily obtained from the support portals. Consequently, tourists are required to manually conduct analyses, a process that is excessively time-consuming. Nonetheless, the portals have structured data available, accessible through APIs, and could be utilized if the portals perceive an economic incentive to integrate such a service.

The consideration of future prospects entails the potential automation and integration of this type of decision support within large portals as a specialized decision support service.

Literature

AI-based customization in the tourism should be interpreted from two aspects: from point of view of the touristic experts and from point of view of the AI.

Customization-needs and -possibilities from point of view of the touristic experts will be presented during the conference: https://miau.my-x.hu/miau/313/accommodation/20240630final2.pptx

Customization from point of view of the AI: An AI-based approach concerning the customization of decision-making about accommodations should be interpreted into a context-free approximation of the decision-making processes. The context-free characterization means it might not be relevant whether the analysed decision-making process is about accommodation, tickets, events, etc. Price-performance-analyses should namely be defined as a frame – independent from the analysed objects and/or attributes. The AI is capable of delivering the optimized price-performance-analyses (c.f. https://miau.my-x.hu/myx-free/), where the customization has two different layers: in the classic case, the decision makers (tourists) can set a binary parameter for each attribute (0 = the more Xi / the higher is the price, 1 = the more Xi / the higher is the price). In special cases, optimum-oriented ceteris paribus relationships might also be simulated (e.g. based on doubled attributes with two antagonistic directions in a parallel way). In the advanced case, the decision makers (tourists) have the possibility to define the ideal constellation of the performance vector (concerning each attribute). The ideal constellation is a kind of benchmark. Each real offer (e.g. accommodation) can be compared to this benchmark step by step (attribute by attribute). This comparison leads to a new OAM (object-attribute-matrix), where parallel to the raw data, the differences between the ideal raw values and the real raw values are stored. The ideal-driven analyses have a prescription concerning the directions: the less is the difference between the ideal value and the real value, the higher might be the price. It means it should be paid for the more and more close approximation of the ideal constellation (https://miau.my-x.hu/miau2009/index.php3?x=e0&string=ideal-).

The direction-oriented classic approach expects real, but rational efforts from the tourists concerning the term of performance in case of each attribute. The ideal-driven approach expects a static statement about the ideal performance constellation (where the directions are already trivial). As it can be seen, both approaches need efforts from the tourists. There is also an effortless decision situation, where the tourists do not want to set parameters or they do not be capable of setting parameters (https://miau.my-x.hu/miau/263/bank-var-13.xlsx). This preference-less version is not a relevant type of the finetuned customization being focused in the article.

About the own AI-solution

The own solution can be imagined as an online service where the tourists do compare the potential accommodations based on all their attributes. This kind of data-constellation is a filtered data-asset in case of the booking portals. The tourists can set filter-options for each attribute being represented in the database about the offered accommodation-possibilities like types of beds, own shower yes/no, distances to different objects, etc. The online service will calculate an estimated priced based on the factual prices and the performance data behind them. The estimation can be validated, and it is ab-ovo an optimized calculation.

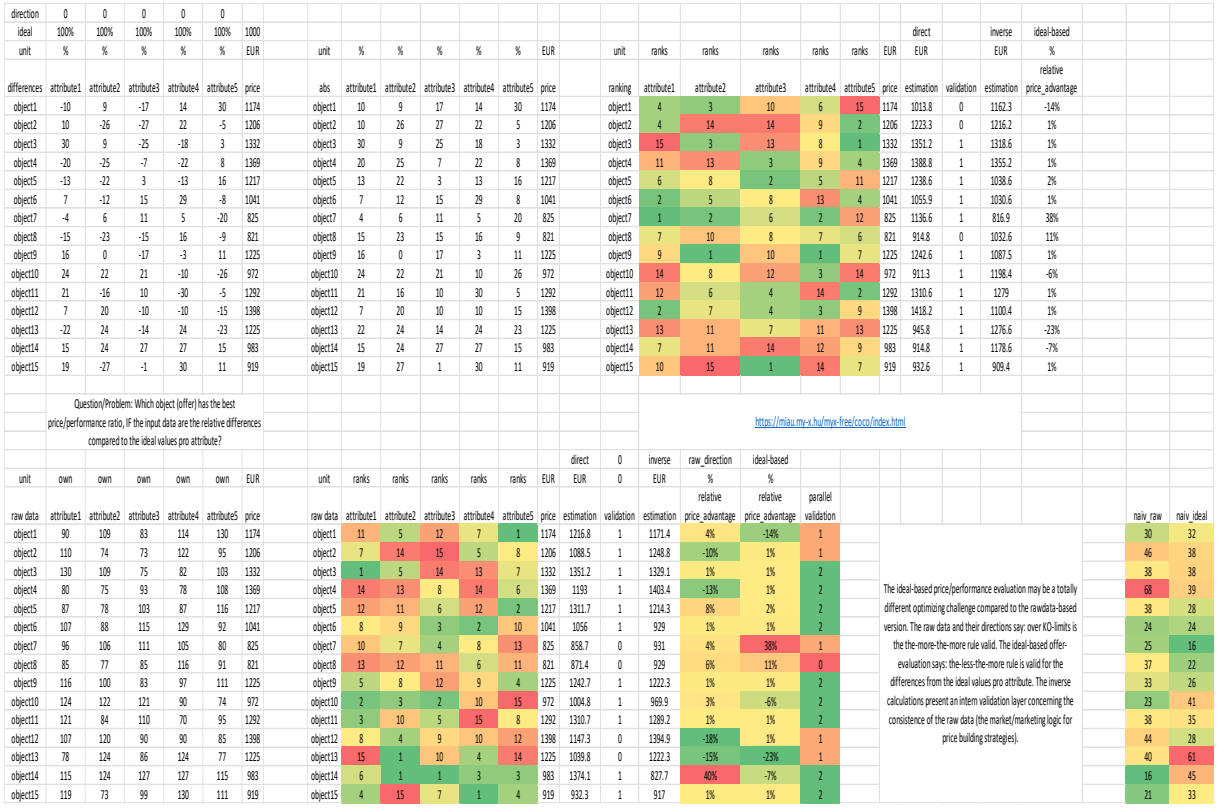
Needed data-asset

The accommodation-oriented data-asset is given in general in the daily business (c.f. booking.com, tripadvisor.com, etc.): These portals are prepared to handle appropriate data-assets and to ensure filtered OAMs. On the other hand, these portals are not prepared to compare the filtered objects (the competing accommodations). Data-visualization is given, but the optimized comparison is not even in the planning phase.

The raw data about the similar (filtered) objects covering the filter-options e.g. as K.O. criteria. But the tourists do not have the possibility to define directions for the focused attributes, let alone, to analyse the similarities between prices and the multidimension described performances based on these raw data. Real price-performance-analyses can not even be identified in case of public procurement processes. The tourism industry could be the first one where the price-performance-analyses will be handled in an optimized and automated way.

AI-based data-processing

The similarity analyses, as a complex (chained) process need the raw OAM and the directions or the ideal constellation instead of the directions concerning the attributes. The next steps present the whole process in a reproducible form:



direction	0	0	0	0	0	
ideal	100%	100%	100%	100%	100%	1000
unit	%	%	%	%	%	EUR
differences	attribute1	attribute2	attribute3	attribute4	attribute5	price
object1	-10	9	-17	14	30	1174
object2	10	-26	-27	22	-5	1206
object3	30	9	-25	-18	3	1332
object4	-20	-25	-7	-22	8	1369
object5	-13	-22	3	-13	16	1217
object6	7	-12	15	29	-8	1041
object7	-4	6	11	5	-20	825
object8	-15	-23	-15	16	-9	821
object9	16	0	-17	-3	11	1225
object10	24	22	21	-10	-26	972
object11	21	-16	10	-30	-5	1292
object12	7	20	-10	-10	-15	1398
object13	-22	24	-14	24	-23	1225
object14	15	24	27	27	15	983
object15	19	-27	-1	30	11	919

Question/Problem: Which object (offer) has the best price/performance ratio, IF the input data are the relative differences compared to the ideal values pro attribute?

unit	own	own	own	own	own	EUR
raw data	attribute1	attribute2	attribute3	attribute4	attribute5	price
object1	90	109	83	114	130	1174
object2	110	74	73	122	95	1206
object3	130	109	75	82	103	1332
object4	80	75	93	78	108	1369
object5	87	78	103	87	116	1217
object6	107	88	115	129	92	1041
object7	96	106	111	105	80	825
object8	85	77	85	116	91	821
object9	116	100	83	97	111	1225
object10	124	122	121	90	74	972
object11	121	84	110	70	95	1292
object12	107	120	90	90	85	1398
object13	78	124	86	124	77	1225
object14	115	124	127	127	115	983
object15	119	73	99	130	111	919

unit	abs	attribute1	attribute2	attribute3	attribute4	attribute5	price
object1	10	9	17	14	30	1174
object2	10	26	27	22	5	1206
object3	30	9	25	18	3	1332
object4	20	25	7	22	8	1369
object5	13	22	3	13	16	1217
object6	7	12	15	29	8	1041
object7	4	6	11	5	20	825
object8	15	23	15	16	9	821
object9	16	0	17	3	11	1225
object10	24	22	21	10	26	972
object11	21	16	10	30	5	1292
object12	7	20	10	10	15	1398
object13	22	24	14	24	23	1225
object14	15	24	27	27	15	983
object15	19	27	1	30	11	919

unit	ranks	ranks	ranks	ranks	ranks	EUR	direct	inverse	ideal-based
ranking	attribute1	attribute2	attribute3	attribute4	attribute5	price	estimation	validation	estimation	relative price_advantage
object1	4	3	10	6	15	1174	1013.8	0	1162.3	-14%
object2	4	14	14	9	2	1206	1223.3	0	1216.2	1%
object3	15	3	13	8	1	1332	1351.2	1	1318.6	1%
object4	11	13	3	9	4	1369	1388.8	1	1355.2	1%
object5	6	8	2	5	11	1217	1238.6	1	1038.6	2%
object6	2	5	8	13	4	1041	1055.9	1	1030.6	1%
object7	1	2	6	2	12	825	1136.6	1	816.9	38%
object8	7	10	8	7	6	821	914.8	0	1032.6	11%
object9	9	1	10	1	7	1225	1242.6	1	1087.5	1%
object10	14	8	12	3	14	972	911.3	1	1198.4	-6%
object11	12	6	4	14	2	1292	1310.6	1	1279	1%
object12	2	7	4	3	9	1398	1418.2	1	1100.4	1%
object13	13	11	7	11	13	1225	945.8	1	1276.6	-23%
object14	7	11	14	12	9	983	914.8	1	1178.6	-7%
object15	10	15	1	14	7	919	932.6	1	909.4	1%

https://miau.my-x.hu/myx-free/coco/index.html

unit	ranks	ranks	ranks	ranks	ranks	EUR	direct	0	inverse	raw_direction	ideal-based
raw data	attribute1	attribute2	attribute3	attribute4	attribute5	price	estimation	validation	estimation	relative price_advantage	relative price_advantage	parallel validation
object1	11	5	12	7	1	1174	1216.8	1	1171.4	4%	-14%	1
object2	7	14	15	5	8	1206	1088.5	1	1248.8	-10%	1%	1
object3	1	5	14	13	7	1332	1351.2	1	1329.1	1%	1%	2
object4	14	13	8	14	6	1369	1193	1	1403.4	-13%	1%	2
object5	12	11	6	12	2	1217	1311.7	1	1214.3	8%	2%	2
object6	8	9	3	2	10	1041	1056	1	929	1%	1%	2
object7	10	7	4	8	13	825	858.7	0	931	4%	38%	1
object8	13	12	11	6	11	821	871.4	0	929	6%	11%	0
object9	5	8	12	9	4	1225	1242.7	1	1222.3	1%	1%	2
object10	2	3	2	10	15	972	1004.8	1	969.9	3%	-6%	2
object11	3	10	5	15	8	1292	1310.7	1	1289.2	1%	1%	2
object12	8	4	9	10	12	1398	1147.3	0	1394.9	-18%	1%	1
object13	15	1	10	4	14	1225	1039.8	0	1222.3	-15%	-23%	1
object14	6	1	1	3	3	983	1374.1	1	827.7	40%	-7%	2
object15	4	15	7	1	4	919	932.3	1	917	1%	1%	2

The ideal-based price/performance evaluation may be a totally different optimizing challenge compared to the rawdata-based version. The raw data and their directions say: over KO-limits is the the-more-the-more rule valid. The ideal-based offer-evaluation says: the-less-the-more rule is valid for the differences from the ideal values pro attribute. The inverse calculations present an intern validation layer concerning the consistence of the raw data (the market/marketing logic for price building strategies).

naiv_raw	naiv_ideal
30	32
46	38
38	38
68	39
38	28
24	24
25	16
37	22
33	26
23	41
38	35
44	28
40	61
16	45
21	33

Figure-1: The ideal-driven price-performance-analysis (source: own presentation) – For more details: see https://miau.my-x.hu/miau/313/accommodation/price_performance_compared_ideal_accomm.xlsx

The context-free steps start with the differences between the ideal constellation (see always 100%) and the relativized raw data (see +/- values in %). The price should be given in the original unit (e.g. euro). Each row is an object (here and now an accommodation). Each column is an attribute describing the objects as such.

The difference between the ideal value of an attribute and the raw data of an accommodation can be positive or negative (or even zero). The signs can be relevant, and in this case, each attribute should be doubled: one column for the positive and an other one for the negative differences. But the predefined directions are always the same: the less is the difference, the higher might be the price. The signs can be eliminated based on the ABS() function (in Excel) too.

The next step is the ranking of the percentual absolute differences between the ideal and the raw data. This ranking can be interpreted as a kind of standardization where the (potential different) units will be substituted with ranking numbers between 1 and "n" where "n" is the number of the objects (c.f. number of the competing accommodations). The ranking process should always use the predefined directions (the less is the difference the higher is the price).

Based on the ranked input about the performances and the raw prices, the free online analytical service of the MY-X server (https://miau.my-x.hu/myx-free/) delivers immediately the outputs. The outputs are (first of all) the estimated prices.

These estimations can be validated if an inverse (mirrored) input-constellation concerning the performances let derive new estimations. The ideal case for validation is trivial: the mirrored input should lead to a mirrored output. It means the estimated price for the real data should have an other sign than the mirrored estimation for the same accommodation.

The interpretation of the estimated (and validated) prices is trivial: if the estimation and the factual prices are the same, then we can speak about a norm-like pricing. If the estimation is lower than the real price, then we should speak about a too expensive accommodation, and vice versa. The not valid estimations lead to avoiding a robotized expertise concerning the given accommodation.

Naïve estimations can also be calculated (like average grades in the schools), but these approximations bring different risks - depending on the raw data. These intuitive approaches can be relative robust but in other cases they are totally wrong.

Based on the optimized and automated estimations, the tourists can see, which accommodations can be interpreted as ideal-oriented AND parallel price-optimized.

Discussions

The presented analytical process tries to interpret the price-building-logic based on the filtered OAM (where not only real options are permitted but also reference objects which should not even be bookable, but the price-performance-constellations are public).

The less is the amount of the objects and/or the more is the number of the attributes in the OAM, the more frequent is a seemingly norm-like situation.

The price-building-logic (the substitution price-components for different approximation levels compared to the ideal object) are more realistic if the volume of the OAM is bigger. On the other hand, more data is not a better model – especially in case of extreme data (c.f. https://miau.my-x.hu/miau/310/OAM_99_60_1kor.xlsx).

Conclusions

Customization means we make possible for the tourist to set such arbitrary parameters for the optimization processes where the personalized preferences can have a clear impact on the calculations.

The psychologists and/or marketing experts talk about emotion-driven, irrational decision making. But this is not correct: the human beings are massive intuition machines. Some intuitions can be interpreted in the conscious levels and other ones not. These unconscious phenomena are not emotions, they are simple estimations not contaminated with the magic of words (with the seemingly rational interpretations of complex systems).

AI is capable of handling data and optimizing processes in a way that all the human phenomena can be simulated in quasi arbitrary qualitative and detailed way.

Conclusions from point of view of the touristic experts will be presented during the conference: https://miau.my-x.hu/miau/313/accommodation/20240630final2.pptx

Future

Price-performance-analyses can lead to seemingly norm-like prices, but these prices can be analysed in further steps (c.f. STEP-IX method: https://miau.my-x.hu/miau/311/server/). These additional analyses deliver information about the range of the norm-like prices based on fast and/or detailed calculation processes (c.f. https://miau.my-x.hu/miau/310/szerver_ar_telj_stepix_gyorsitott_teljes21.xlsx).

References

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